

This listing of claims will replace all prior versions, and listings, of claims in the application.

**Listing of Claims:**

1. (Currently amended) An isolated and purified polynucleotide, ~~or a variant, fragment, or analog thereof~~, encoding a codeinone reductase enzyme from an alkaloid poppy plant, wherein said codeinone reductase enzyme is as set forth in SEQ ID NO: 26, SEQ ID NO: 27, SEQ ID NO: 28, or SEQ ID NO: 29.
2. (Original) A polynucleotide according to claim 1, selected from the group consisting of genomic DNA, cDNA, or synthetic DNA.
3. (Currently amended) A polynucleotide according to claim 1, selected from the group consisting of
  - (a) the polynucleotide sequences ~~show in FIGS 10 to 15~~ as set forth in SEQ ID NO:20, SEQ ID NO:21, SEQ ID NO:22, or SEQ ID NO:23;
  - (b) the polynucleotide sequences which hybridize under stringent conditions to the complementary sequences of (a); ~~and~~
  - (c) ~~polynucleotide sequences which are degenerate to polynucleotide sequences of (a) or (b).~~
4. (Previously presented) A polynucleotide according to claim 1, lacking the native leader sequences or any of the 5' or 3' untranslated regions of the polynucleotide.
5. (Currently amended) A polynucleotide according to claim 4, wherein the native leader sequences or any of the 5' or 3' untranslated regions are replaced with exogenous ~~control~~/regulatory sequences which regulate ~~optimized~~/enhanced expression of the polynucleotide in an expression system
6. (Previously presented) A polynucleotide according to claim 1, which encodes codeinone reductase enzyme of *Papaver somniferum*.

7. (Previously presented) A polynucleotide according to claim 1, which is a synthetic polynucleotide comprising one or more codons preferred for expression in plant cells.

8. (Currently amended) An isolated and purified polynucleotide which codes for prokaryotic or eukaryotic expression of a codeinone reductase enzyme from an alkaloid poppy plant, ~~or a variant, analog, or fragment thereof~~, wherein the polynucleotide is expressed in an environment selected from the group consisting of the extracellular environment, an intracellular membrane compartment, intracellular cytoplasmic compartment or combinations, and wherein said codeinone reductase enzyme is as set forth in SEQ ID NO: 26, SEQ ID NO: 27, SEQ ID NO: 28, or SEQ ID NO: 29.

9. (Original) A polynucleotide according to claim 8, comprising a nucleotide sequence which directs expression of the codeinone reductase enzyme with respect to a particular cellular compartment or the extracellular environment.

10. (Amended) An isolated and purified polynucleotide having a sequence which is complementary to all or part of the sequence of a polynucleotide according to claim 1.

11. (Previously presented) A recombinant DNA construct comprising the polynucleotide according to claim 1.

12. (Original) A DNA construct according to claim 11, which is a viral or plasmid vector.

13. (Previously presented) A DNA construct according to claim 11 capable of directing prokaryotic or eukaryotic expression of the polynucleotide encoding a codeinone reductase enzyme.

14. (Previously presented) A DNA construct according to claim 11, comprising a promoter suitable to control the expression of the polynucleotide.
15. (Original) A DNA construct according to claim 14, wherein the promoter is endogenous.
16. (Original) A DNA construct according to claim 14, wherein the promoter is derived from nos, cauliflower mosaic virus or subterranean clover mosaic virus.
17. (Original) A DNA construct according to claim 12, wherein the plasmid is pCAL-c.
18. (Original) A DNA construct according to claim 12, wherein the plasmid is pGEM-T.
19. (Original) A DNA construct according to claim 12, wherein the plasmid is pFastBacI.
20. (Currently amended) An isolated and purified codeinone reductase enzyme, being a product of prokaryotic or eukaryotic expression of the polynucleotide of claim 1 wherein said codeinone reductase enzyme is as set forth in SEQ ID NO: 26, SEQ ID NO: 27, SEQ ID NO: 28, or SEQ ID NO: 29.
21. (Original) An enzyme according to claim 20, being a product of yeast cell expression.
22. (Original) An enzyme according to claim 20, being a product of bacterial cell expression.
23. (Original) An enzyme according to claim 20, being a product of animal cell expression.

24. (Original) An enzyme according to claim 23, being a product of insect cell expression.
25. (Original) An enzyme according to claim 20, being a product of plant cell expression.
26. (Original) An enzyme according to claim 25, wherein the plant cell is an alkaloid poppy plant cell.
27. (Original) An enzyme according to claim 26, wherein the alkaloid plant is *Papaver somniferum*.
28. (Canceled)
29. (Previously presented) A cell transformed or transfected with a polynucleotide according to claim 1.
30. (Original) A cell according to claim 29, which is a plant cell.
31. (Original) A cell according to claim 30, wherein the plant cell is derived from an alkaloid poppy plant.
32. (Original) A cell according to claim 31, wherein the poppy plant is *Papaver somniferum*.
33. (Original) A cell according to claim 29, which is a bacterial cell.
34. (Original) A cell according to claim 29, which is an animal cell.
35. (Original) A cell according to claim 29, which is a yeast cell.

36. (Previously presented) A callus transformed or transfected with a polynucleotide according to claim 1.

37. (Previously presented) A plant transformed or transfected with a polynucleotide according to claim 1, wherein the plant exhibits altered expression of the codeinone reductase enzyme.

38. (Original) A plant according to claim 37, wherein the altered expression is overexpression of the codeinone reductase enzyme.

39. (Original) A plant according to claim 37, wherein the altered expression is reduced expression of the codeinone reductase enzyme.

40. (Previously presented) A plant according to claim 37, which is an alkaloid poppy plant.

41. (Original) A plant according to claim 40, wherein the plant has a higher or different alkaloid content when compared to a plant which has not been so transformed or transfected.

42. (Previously presented) A plant according to claim 40, wherein the alkaloid poppy plant is *Papaver somniferum*.

43. (Previously presented) A method for preparing plants which overexpress a codeinone reductase enzyme, comprising transfecting or transforming a plant cell, a plant part or a plant, with the polynucleotide according to claim 1.

44. (Original) A method according to claim 43, wherein the plant is an alkaloid poppy plant.

45. (Original) A method according to claim 44, wherein the poppy plant is *Papaver somniferum*.

46. (Currently amended) A method of altering the yield or type of alkaloid in a plant comprising transforming or transfecting a plant cell, a plant part, or a plant with a polynucleotide, ~~or a variant, analog, or fragment thereof~~, encoding a codeinone reductase enzyme or with a polynucleotide which binds under stringent conditions to the polynucleotide encoding said enzyme wherein said codeinone reductase enzyme is as set forth in SEQ ID NO: 26, SEQ ID NO: 27, SEQ ID NO: 28, or SEQ ID NO: 29.

47. (Currently amended) A method of increasing the yield of alkaloid in a plant comprising transforming or transfecting a plant cell, a plant part, or a plant with a polynucleotide, ~~or a variant, analog, or fragment thereof~~, encoding a codeinone reductase enzyme wherein the enzyme is overexpressed in said plant or with a polynucleotide which binds under stringent conditions to the polynucleotide encoding said enzyme wherein said codeinone reductase enzyme is as set forth in SEQ ID NO: 26, SEQ ID NO: 27, SEQ ID NO: 28, or SEQ ID NO: 29.

48. (Currently amended) A method of altering type or blend of alkaloid in a plant comprising transforming or transfecting a plant cell, a plant part, or a plant with a polynucleotide, ~~or a variant, analog, or fragment thereof~~, encoding a codeinone reductase enzyme or with a polynucleotide which binds under stringent conditions to the polynucleotide encoding said enzyme wherein said codeinone reductase enzyme is as set forth in SEQ ID NO: 26, SEQ ID NO: 27, SEQ ID NO: 28, or SEQ ID NO: 29.

49. (Previously presented) A stand of stably reproducing alkaloid poppies transformed or transfected with a polynucleotide according to claim 1 having altered expression of the codeinone reductase enzyme.

50. (Previously presented) A stand of stably reproducing alkaloid poppies transformed or transfected with a polynucleotide according to claim 1 having a higher or

different alkaloid content when compared to a plant which has not been so transformed or transfected.

51. (Previously presented) A stand of stably reproducing alkaloid poppies according to claim 49 wherein the alkaloid poppy is *Papaver somniferum*.

52. (Previously presented) Straw of stably reproducing poppies according to claim 49 having a higher or different alkaloid content when compared to the straw obtained from an alkaloid poppy which has not been transformed or transfected.

53. (Original) A concentrate of straw according to claim 52, having a higher or different alkaloid content when compared to the concentrate of straw obtained from an alkaloid poppy which has not been transformed or transfected.

54. (Previously presented) An alkaloid when isolated from the straw according to claim 53.

55. (Original) An alkaloid according to claim 54, selected from the group consisting of morphine, codeine, oripavine and thebaine.

56. (Previously presented) A method for the production of poppy plant alkaloids, comprising the steps of;

- a) harvesting capsules of an alkaloid poppy plant transformed or transfected with a polynucleotide according to claim 1, to produce a straw where the poppy plant is such a plant that the straw has a higher or different alkaloid content when compared to the straw obtained from a poppy plant which has not been transformed or transfected, and
- b) chemically extracting the alkaloids from the straw.

57. (Previously presented) A method for the production of poppy alkaloids, comprising the steps of;

- a) collecting and drying the latex of the immature capsules of an alkaloid poppy plant transformed or transfected with a polynucleotide according to claim 1, to produce opium wherein the poppy plant is such a plant that the opium has a higher or different alkaloid content when compared to the opium obtained from a poppy plant which has not been transformed or transfected, and
- b) chemically extracting the alkaloids from the opium.

58. (Previously presented) A method according to claim 56 wherein the alkaloid is selected from the group consisting of morphine, codeine, oripavine and thebaine.

59. (Original) The polynucleotide sequence encoding codeinone reductase comprised in microbial deposit DSM 12737.

60. (Original) The polynucleotide sequence encoding codeinone reductase comprised in microbial deposit DSM 12738.

61. (Original) The polynucleotide sequence encoding codeinone reductase comprised in microbial deposit DSM 12739.

62. (Original) The polynucleotide sequence encoding codeinone reductase comprised in microbial deposit DSM 12740.